DETAILED ACTION

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows: Previously cancelled claim 25 is included in the list of amended claims as follows:

Claim 25 (Cancelled)

Allowable Subject Matter

Claims 1-6, 17, and 23-24 are allowed.

The closest prior art references are Gruenberger et al (Continuous Production of Fullerenes and Other Carbon Nanomaterials on a Semi-Industrial Scale using Plasma Technology, 2002), Rao et al (US 5,874,134), Yuill (US 2002/00192138 A1), and Hilgers et al (US 3,586,489).

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, Gruenberger et al discloses a reactor for the production of nanoparticles in an aerosol process comprising: (a) a reaction chamber having a wall, an inlet and an outlet the inlet for introducing a hot carrier gas to the reaction chamber which hot carrier gas flows downward from the inlet through the reaction chamber and

out the outlet, (b) a quench zone located downstream of the reaction chamber having an inlet and an outlet, (c) one or more quench inlets being positioned approximately about the outlet of the reaction chamber for introducing a quench material (see pages 8-9 and figure 1).

Rao et al discloses a reactor wherein the tubular region converges twice and has radially distributed reactant inlets (see figure 2A and column 6, lines 3-61).

The prior art references do not disclose or suggest (d) radially distributed reactant inlets positioned between the reaction chamber inlet and the quench inlets for introducing one or more reactants; the reaction chamber comprising a spacer zone and a homogenization zone: (i) a spacer zone having a length, (L1), extending from the reaction chamber inlet and ending approximately about the reactant inlets having an upper diameter converging, upstream of the reactant inlets, to a lower diameter tubular region, the spacer zone having a recirculation zone, the reactant inlets being downstream of the recirculation zone and positioned to introduce reactants into the tubular region which extends into the homogenization zone and
(ii) the homogenization zone including the tubular region which is followed by a converging section which converges to a nozzle tip, the homogenization zone having a length (L2) extending from approximately the location of the reactant inlets and ending approximately about the quench zone inlet; the spacer zone for allowing the hot carrier gas to carry the reactants downward towards the homogenization zone, the homogenization zone for contacting the reactants under conditions suitable for forming a reaction product and passing the reaction product to the quench zone, (L1) being

sufficient for the hot carrier gas to attach to the wall of the spacer zone of the reaction chamber prior to the reactant inlets and (L2) being sufficient for a residence time of the reactants within the homogenization zone suitable for forming the reaction product which when withdrawn from the outlet of the quench zone are nanoparticles.

Claims 2-6 and 23-24 depend on claim 1.

Regarding claim 17, Gruenberger et al discloses a reaction chamber for minimizing flow recirculation in a reactor for the production of reaction product nanoparticles, the reaction chamber comprising a wall, an entrance and an exit a hot carrier gas inlet located about the entrance of the reaction chamber and quench material inlets located about the exit of the reaction chamber (see pages 8-9 and figure 1).

Rao et al discloses a reactor wherein the tubular region converges twice and has radially distributed reactant inlets (see figure 2A and column 6, lines 3-61).

The prior art references do not disclose or suggest radially distributed reactant located between the hot carrier gas inlet and the quench inlets, the reactant inlets being located downstream of a recirculation zone created by the hot carrier gas as it flows downward from the hot carrier gas inlet toward reactant inlets, the hot carrier gas inlet and reactant inlets being oriented for a downward flow direction of the hot carrier gas and reactant, the reaction chamber comprising a spacer zone and a homogenization zone (i) the spacer zone having a length, (L1), extending from the reaction chamber entrance and ending about the reactant inlets having an upper diameter converging, upstream of the reactant inlets, to a lower diameter tubular region which reactant inlets

are positioned to introduce reactants into the tubular region, the tubular region extending into the homogenization zone, and (ii) the homogenization zone including the tubular region followed by a converging section which converges to a nozzle tip and having a length (L2) extending from the reactant inlets to a position downstream of the quench inlets for contacting the hot carrier gas and the reactants and wherein (L1) of the spacer zone is sufficient for the hot carrier gas to attach to the wall of the reaction chamber before the hot carrier gas reaches the reactant inlets and (L2) of the reaction chamber being sufficient for a residence time within the homogenization zone suitable for forming the reaction product nanoparticles.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATASHA YOUNG whose telephone number is 571-270-3163. The examiner can normally be reached on Mon-Thurs 7:30 am-6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on 571-272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. Y./
Examiner, Art Unit 1797

/Walter D. Griffin/
Supervisory Patent Examiner, Art Unit 1797